

Draft Recovery Plan
for
Sidalcea oregana var. *calva*
(Wenatchee Mountains checker-mallow)



Wenatchee Mountains checker-mallow (*Sidalcea oregana* var. *calva*)
Photo by Ted Thomas/USFWS

Cover photograph of *Sidalcea oregana* var. *calva* (Wenatchee Mountains checker-mallow) by Ted Thomas, U.S. Fish and Wildlife Service.

Draft Recovery Plan
for
Sidalcea oregana var. calva
(Wenatchee Mountains checker-mallow)

(August 2003)

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Approved:

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

Regional Director, Region 1
U.S. Fish and Wildlife Service

Date:

DISCLAIMER

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views or the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U. S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service *only* after they have been signed by the Director or Regional Director as *approved*. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions.

Literature citation of this document should read as follows:

U.S. Fish and Wildlife Service. 2003. Draft recovery plan for *Sidalcea oregana* var. *calva* (Wenatchee Mountains checker-mallow). U.S. Fish and Wildlife Service, Portland, Oregon. x + 48 pp.

An electronic copy of this recovery plan will be made available at <http://pacific.fws.gov/ecoservices/endangered/recovery/default.htm> and also at <http://endangered.fws.gov/recovery/index.html>.

ACKNOWLEDGMENTS

The primary authors of this recovery plan are Florence Caplow, Botanist, Washington Department of Natural Resources Natural Heritage Program; Ted Thomas, Chief, Branch of Listing and Recovery, U.S. Fish and Wildlife Service; David Wilderman, Plant Ecologist, Washington Department of Natural Resources Natural Areas Program; and Lauri Malmquist, Botanist, U.S. Forest Service. We gratefully acknowledge the following individuals for their valuable contributions to our knowledge of *Sidalcea oregana* var. *calva*, and to this recovery plan: Ron Taylor (deceased), Professor of Botany, Western Washington University; Arthur Kruckeberg, emeritus, Professor of Botany, University of Washington; John Gamon, Washington Department of Natural Resources Natural Heritage Program Manager; and Richy Harrod, Fire Ecologist, Wenatchee National Forest. We are indebted to them for their long-term commitment to botanical conservation and specifically their concerns regarding the taxonomy and decline of *Sidalcea oregana* var. *calva*. We thank Tara Goldsmith for sharing the results of her research on *Sidalcea oregana* var. *calva* in regard to pollination vectors, weevil predation and response to fire. Tara's work was done in the course of attaining her Master of Science degree in Urban Horticulture from the College of Forest Resources, University of Washington. Dr. Sarah Reichard of the University of Washington was helpful in sharing the results of seed germination studies conducted in her lab. We also acknowledge the contribution to our understanding of the soil moisture requirements of this species summarized in a 2001 report by Amy Bleckinger, as partial fulfillment of the requirements for her Master of Science degree in Environmental Management, Nicholas School of the Environment and Earth Sciences, Duke University. The authors gratefully acknowledge the thoughtful and thorough review and editing of this recovery plan by Dr. Karolee Owens, U.S. Fish and Wildlife Service, Lacey, Washington. The content of this plan and policy decisions (such as recovery criteria) are the responsibility of the U.S. Fish and Wildlife Service.

The interest and support of agencies and organizations, including the U.S. Forest Service, the Washington Department of Natural Resources, and The Nature Conservancy of Washington, are acknowledged for their contributions to our knowledge of *Sidalcea oregana* var. *calva* and to this recovery plan.

Support for the primary authors of this draft recovery plan was provided by their respective agencies and through section 6 (of the Endangered Species Act) funding to Washington State. Support for Florence Caplow's contribution to the plan was provided by the U.S. Fish and Wildlife Service and the Washington Department of Natural Resources Natural Heritage Program. Ted Thomas's contributions were supported by the U.S. Fish and Wildlife Service. David Wilderman's work was supported by the Washington Department of Natural Resources, Natural Areas Program, and Lauri Malmquist's efforts were supported by the U.S. Forest Service, Wenatchee National Forest.

We would like to especially thank Dinea Norrell for providing us with her excellent illustration of *Sidalcea oregana* var. *calva*. Its use in this plan does not imply any further right of reproduction without authorization from the artist.

EXECUTIVE SUMMARY

Current Status: *Sidalcea oregana* var. *calva* (Wenatchee Mountains checker-mallow), listed as endangered on December 22, 1999 (U.S. Fish and Wildlife Service [USFWS] 1999), is endemic to Chelan County in eastern Washington. The populations are generally small in terms of both the number of plants and the amount of area covered by each population. Just five populations are known, and four of these five populations number from only eight individuals to a few hundred. The largest of the known populations with approximately 11,000 individuals is from a mixture of private, State and Federal lands. Of the remaining populations, one is from Federal lands, one is from State land, and two are from private lands. Critical habitat was designated for this species on September 6, 2001 (USFWS 2001).

Recovery Priority: This plant's recovery priority number is 3 on a scale of 1 to 18 (USFWS 1983a,b) reflecting a high degree of threat, a high potential for recovery, and the plant's taxonomic status as a variety.

Habitat Requirements and Limiting Factors: *S. oregana* var. *calva* is restricted to wetlands and moist meadows of the Wenatchee Mountains of central Washington. This species is found at mid-elevations, ranging from 488 to 1,000 meters (1,600 to 3,300 feet). Populations of *S. oregana* var. *calva* are generally concentrated in the wetter portions of open forest-moist meadow habitats, in slight topographic depressions. The plant may also be found in open conifer forests dominated by *Pinus ponderosa* (ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir), on the perimeter of shrub and hardwood thickets dominated by quaking aspen (*Populus tremuloides*), along permanent or intermittent streams in sparsely forested draws, and near seeps, springs, or small drainages. The presence of surface water or saturated upper soil profiles in the spring and early summer is the feature common to the variety of habitats where the species is found.

The physical and biological habitat features essential to the conservation of *S. oregana* var. *calva* include the persistence of surface water or saturated soils well into early summer; a wetland plant community dominated by native grasses

and forbs; an environment generally free of woody shrubs and conifers that produce shade and competition; and the preservation of the natural hydrologic functions on which these areas depend.

Key Threats: The primary threats to *S. oregana* var. *calva* include habitat fragmentation, degradation, or loss due to conversion of native wetlands to orchards and other agricultural uses and rural residential development; altered hydrology; competition from native and nonnative plants; recreational impacts; woody plant encroachment; and activities associated with fire suppression. To a lesser extent the species is threatened by livestock grazing, road construction, and timber harvesting and its associated impacts, including changes in surface runoff. The species is highly vulnerable to extirpation from demographic factors or random, naturally occurring events due to the small size of most of the remaining populations.

Recovery Objective: The objective of this recovery plan is to recover *S. oregana* var. *calva* so that the species can be delisted. The interim objective is to stabilize the existing populations and accomplish increases in population sizes and geographic distribution across the historical range of the species sufficient to consider reclassification or downlisting of *S. oregana* var. *calva* to threatened status.

Recovery Criteria: *S. oregana* var. *calva* will be considered for downlisting when all of the following conditions have been met:

1. There are at least three stable, self-sustaining populations in each of three 5th field watersheds (Peshastin, Icicle, and Swauk) where the species historically occurred or currently occurs. Alternatively, there could be four stable, self-sustaining populations in two 5th field watersheds within the species' historical or current range. Additional populations may be identified through additional surveys or established through reintroductions. To be considered stable and self-sustaining, a population should maintain a 5-year average of at least 500 adult plants, show evidence of positive or neutral population growth over the same 5-year period, and show evidence of natural reproduction and establishment.

2. All of the stable, self-sustaining populations are on protected sites secure from threats. For a site to be considered protected, it must be owned or managed by a government agency or private conservation organization that identifies maintenance of the species as the primary management objective for the site, or the site must be protected by a permanent conservation easement or covenant that commits present and future landowners to the conservation of the species.

3. Genetic material is stored in a facility approved by the Center for Plant Conservation. The stored genetic material in the form of seeds must adequately represent the species' geographic distribution and genetic diversity.

4. Adequate population and habitat monitoring has been established for all of the known populations. Population monitoring must be statistically sound and should be able to detect a 20 percent change in the population with a 90 percent degree of certainty. Habitat monitoring should include monitoring of shrub and tree cover, nonnative species, and hydrology.

5. Management plans have been developed and implemented for all State and federally owned populations. Management plans will include provisions for habitat maintenance and restoration, monitoring, and research, and will define actions designed to reduce or control threats to the species such as noxious weed control and fire management.

Criteria for delisting the species remain the same as those for downlisting, with the following exceptions:

1. The populations that meet downlisting criterion #1 above will be naturally reproducing, stable or increasing in number with a minimum of 500 adult plants, secure from threats, and will have persisted an additional 5 years, for a total of 10 years. All other details of criterion #1 remain unchanged.

One additional criterion is added for delisting:

6. Post-delisting monitoring plans and agreements to continue post-delisting monitoring are in place and ready for implementation at the time of

delisting. Monitoring of populations following delisting will verify the ongoing recovery of the species and provide a means of assessing the continuing effectiveness of management actions.

Recovery Strategy: The first step toward recovery of *S. oregana* var. *calva* is to protect and manage the known populations. Maintenance of these populations will require successful partnerships with public land managers and private landowners. In addition, continuing survey efforts will focus on identifying any populations that may exist but are currently unknown. Recovery may also require increasing the area occupied by existing populations where space and habitat allow, as well as establishing new populations within the historical range of the species. The effective management and reintroduction of *S. oregana* var. *calva* will require gaining further knowledge about the life history of the species and the function of the wetland ecosystems on which it depends. Research and monitoring will therefore be key components of the recovery strategy.

Actions Needed:

1. Maintain the current geographic distribution of the species.
2. Identify and map all populations and identify potential habitat for reintroductions.
3. Conduct research and monitoring essential for the conservation of the species, including how to successfully manage existing populations and establish new populations.
4. Develop and implement a reintroduction plan to establish new populations within the species' historical range.
5. Establish a technical working group.
6. Collect seed from all source populations to represent the range of genetic diversity within the species' range and store the seed in a facility approved by the Center for Plant Conservation.
7. Periodically review the status of the species and assess the effectiveness of the management plans and other recovery actions; review and revise the recovery plan as needed.
8. Develop outreach materials to provide information about the species and its habitat to local landowners.

Estimated Cost of Recovery: The estimated cost to recover *S. oregana* var. *calva* is \$786,000.

Estimated Date of Recovery: If all recovery criteria have been met, delisting could be initiated by the year 2016.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	iv
I. INTRODUCTION	1
A. BRIEF OVERVIEW	1
B. TAXONOMY AND DESCRIPTION	2
C. DISTRIBUTION AND ABUNDANCE	4
D. HABITAT DESCRIPTION	8
E. CRITICAL HABITAT	9
F. LIFE HISTORY AND ECOLOGY	11
G. THREATS AND REASONS FOR LISTING	13
1. The present or threatened destruction, modification, or curtailment of its habitat or range	13
2. Overutilization for commercial, recreational, scientific, or educational purposes	16
3. Disease or predation	16
4. The inadequacy of existing regulatory mechanisms	17
5. Other natural or manmade factors affecting its continued existence	18
H. CONSERVATION MEASURES	19
1. Protections under the Endangered Species Act	19
2. Other Conservation Measures	21
I. CONSIDERATION OF PROPOSED AND CANDIDATE SPECIES, AND SPECIES OF CONCERN	21
J. RECOVERY STRATEGY	22
II. RECOVERY	23
A. RECOVERY OBJECTIVES	23
B. RECOVERY CRITERIA	24
C. NARRATIVE OUTLINE OF RECOVERY ACTIONS	26
1. Maintain the current geographic distribution of the species.	26
2. Identify and map all populations and identify potential habitat for reintroductions.	29

3. Conduct research and monitoring essential for the conservation of the species.	30
4. Establish new populations within the historical range of the species	32
5. Establish a technical working group	33
6. Collect seed and store in a Center for Plant Conservation approved facility	33
7. Review and revise plan	34
8. Develop outreach materials	34
III. IMPLEMENTATION SCHEDULE	35
IV. LITERATURE CITED	41
V. APPENDICES	45
Appendix A. Summary of threats identified for <i>Sidalcea oregana</i> var. <i>calva</i> and recommended recovery actions. Links to recovery criteria are also provided.	45
Appendix B. Glossary	48

LIST OF TABLES

Table 1. Summary of known sites for <i>Sidalcea oregana</i> var. <i>calva</i>	6
---	---

LIST OF FIGURES

Figure 1. Map showing location of Chelan County within the State of Washington	1
Figure 2. Line drawing of <i>Sidalcea oregana</i> var. <i>calva</i>	3
Figure 3. Map of historical and current occurrences of <i>Sidalcea oregana</i> var. <i>calva</i> , showing its distribution in the Icicle, Peshastin, and Swauk drainages.	5
Figure 4. Areas designated as critical habitat for <i>Sidalcea oregana</i> var. <i>calva</i>	10

I. INTRODUCTION

A. BRIEF OVERVIEW

Sidalcea oregana var. *calva* (Wenatchee Mountains checker-mallow) is an endemic plant found only in mid-elevation wetlands and moist meadows within Chelan County in eastern Washington (Figure 1). This plant is known from only five populations. The largest population has an estimated 11,000 plants, and the remaining 4 range in size from 8 to 300 individuals. We, the U.S. Fish and Wildlife Service, listed *S. oregana* var. *calva* as endangered under the provisions of the Endangered Species Act of 1973, as amended (16 United States Code [USC] 1531 *et seq.*) (Act) on December 22, 1999 (U.S. Fish and Wildlife Service [USFWS] 1999). Critical habitat was designated for this species on September 6, 2001 (USFWS 2001). *S. oregana* var. *calva* has a recovery priority ranking of 3 on a scale from 1 to 18 (USFWS 1983a,b). This priority ranking reflects a high degree of threat, a high potential for recovery, and the plant's taxonomic status as a variety.

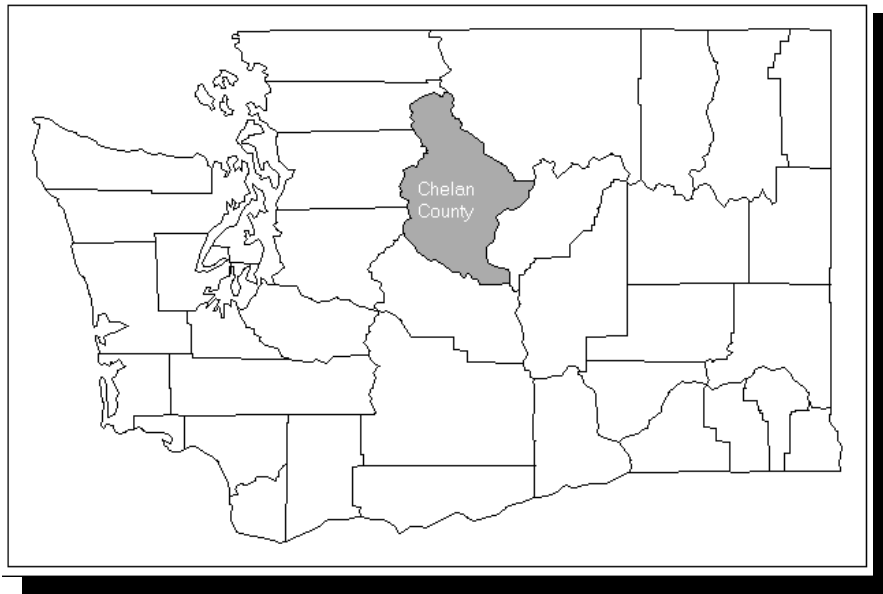


FIGURE 1. Map showing location of Chelan County, Washington.

Much of the habitat where this species occurs is unprotected and suitable for rural residential development and for modification by logging or agriculture. The small populations of this species are particularly vulnerable to extirpation from random natural events. Wildfires, which are a concern in the east-side Cascade forest ecosystem, are the most likely random natural threat to *S. oregana* var. *calva*. Recovery of *S. oregana* var. *calva* will require establishing stable, self-sustaining populations on protected sites and managing or eliminating threats to these populations. This recovery plan recommends actions necessary to assure the recovery of *S. oregana* var. *calva*, including the protection and enhancement of existing populations, the possible reestablishment of populations in areas of suitable habitat within its historical range, research, monitoring, and outreach.

B. TAXONOMY AND DESCRIPTION

S. oregana var. *calva* was first collected in 1893 by Sandberg and Leiburg from the Icicle Creek area, near Leavenworth, and from wet meadows near Peshastin, both in Chelan County, Washington (Washington Department of Natural Resources 2002). The type specimen was collected by C.L. Hitchcock on June 21, 1951, from Camas Land (now Camas Meadows) in Chelan County (herbarium collection, stored in permanent collection at Washington State University and the University of Oregon [Hitchcock #19,427]). The taxon was first recognized as a distinct variety named *S. oregana* ssp. *oregana* var. *calva* by Hitchcock and Kruckeberg (1957). Hitchcock and Cronquist (1973) reduced *S. oregana* ssp. *oregana* to varietal status (*S. oregana* var. *spicata*), thereby eliminating the need to include the subspecies *oregana* as part of the scientific name for this taxon. No further taxonomic revisions have been made.

S. oregana var. *calva* is a perennial herb in the mallow family (Malvaceae) (Figure 2). The species has a stout taproot that branches at the root-crown and gives rise to several stems that are 20 to 150 centimeters (8 to 60 inches) tall. Plant stems vary from glabrous (lacking hairs and glands) to pubescent (hairy) or stellate (with star-shaped hairs) below and are finely stellate above (Hitchcock *et al.* 1961). The leaves are thick and fleshy with long petioles (leaf stalks). The leaves are dimorphic (have two forms) with the lower (basal) leaves having more shallow lobes. The flowers have light- to deep-pink petals 1

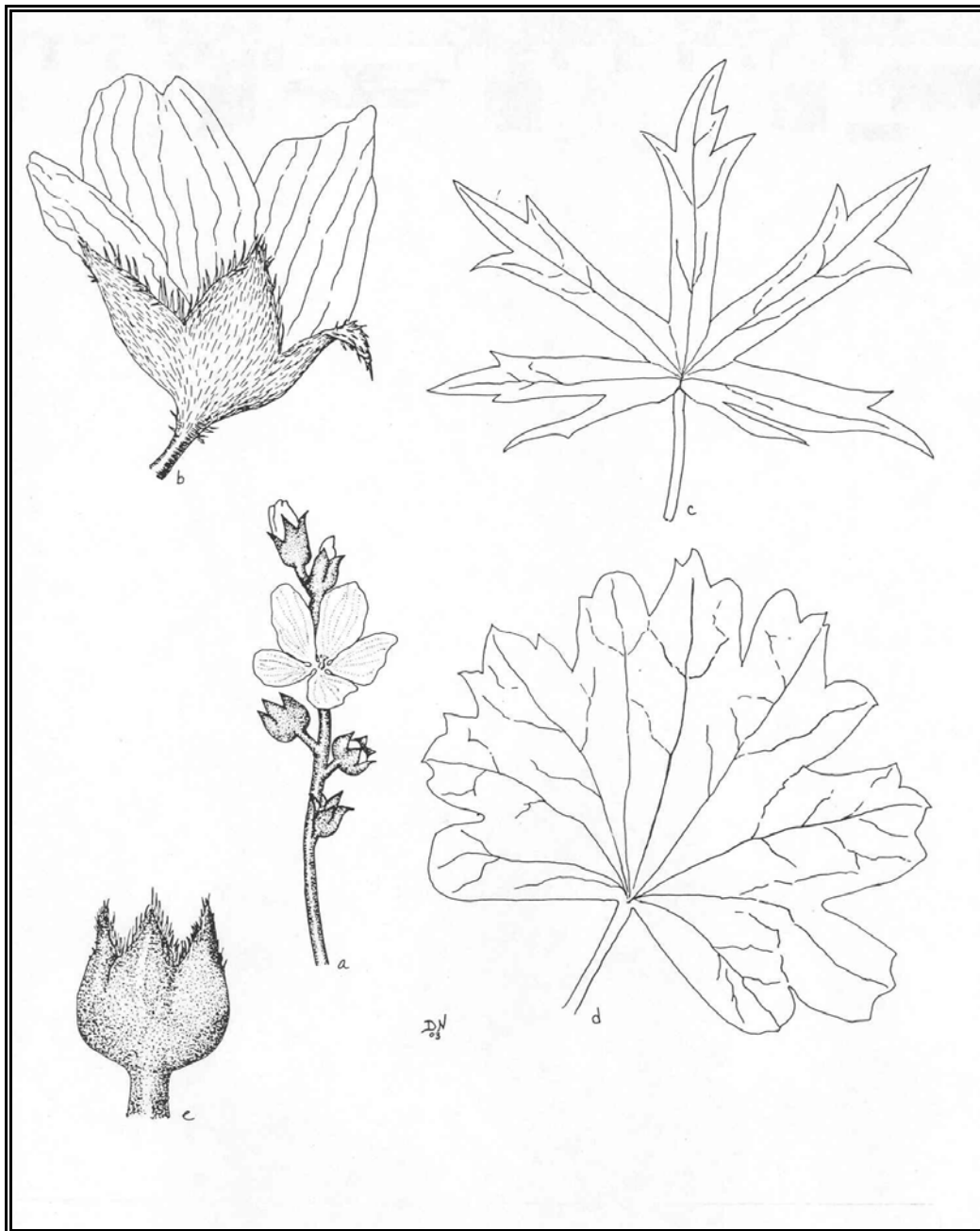


FIGURE 2. a) Inflorescence of *Sidalcea oregana* var. *calva*; b) flower of *S. oregana* var. *calva*; c) stem leaf of *S. oregana* var. *calva*; d) basal leaf of *S. oregana* var. *calva*; e) fruiting calyx of *S. oregana* var. *calva*. Illustration by Dinea Norrell, used with permission.

to 2 centimeters (0.4 to 0.8 inch) long. The flowers are borne on stalks ranging from 1 to 10 millimeters (0.04 to 0.4 inch) in length. The calyx (outer whorl of floral parts) ranges from uniformly finely stellate to bristly with a mixture of longer, simple to four-rayed, spreading hairs sometimes as long as 2.5 to 3 millimeters (0.1 to 0.12 inch) (Hitchcock *et al.* 1961; see Figure 2 for detail). The inflorescence (arrangement of the flowers) consists of one to several loosely flowered racemes (stalked flowers arranged along a single stem) (Caplow 2002).

S. oregana var. *calva* is similar in appearance to *S. oregana* var. *procera*, which occurs in the same geographic region. *S. oregana* var. *calva* can be distinguished from var. *procera* by the presence of the hairs on the margins of the calyx lobes and by its large, fleshy, basal leaves, which are smooth to the touch on both surfaces (Washington Natural Heritage Program and U.S. Bureau of Land Management 1998).

C. DISTRIBUTION AND ABUNDANCE

The historical as well as current range of *S. oregana* var. *calva* is restricted to Chelan County, Washington. The historical range covered an area of approximately 17.7 by 4.8 kilometers (11 by 3 miles), extending south-southeasterly from Leavenworth, Washington, to the area now known as Camas Meadows. Most of the historical records of this species are based upon occurrences in the Icicle and Peshastin watersheds, with one record from the Swauk watershed (Figure 3).

Within its historical range, many of the large meadows that may once have provided suitable habitat for *S. oregana* var. *calva* have since been converted to agricultural or residential use. Of the 12 occurrences of *S. oregana* var. *calva* recorded in the Washington Natural Heritage Information System, 4 of the earliest collections (pre-1940) have imprecise geographic information and cannot be relocated. However, the widespread conversion of lands in the general area of these early collections has likely extirpated these populations. Resurveying of other sites thought to have *S. oregana* var. *calva* revealed plants found to be the closely related *S. oregana* var. *procera* (Gamon 1987), and still other small populations discovered in 1984 have not been relocated, either due to poor

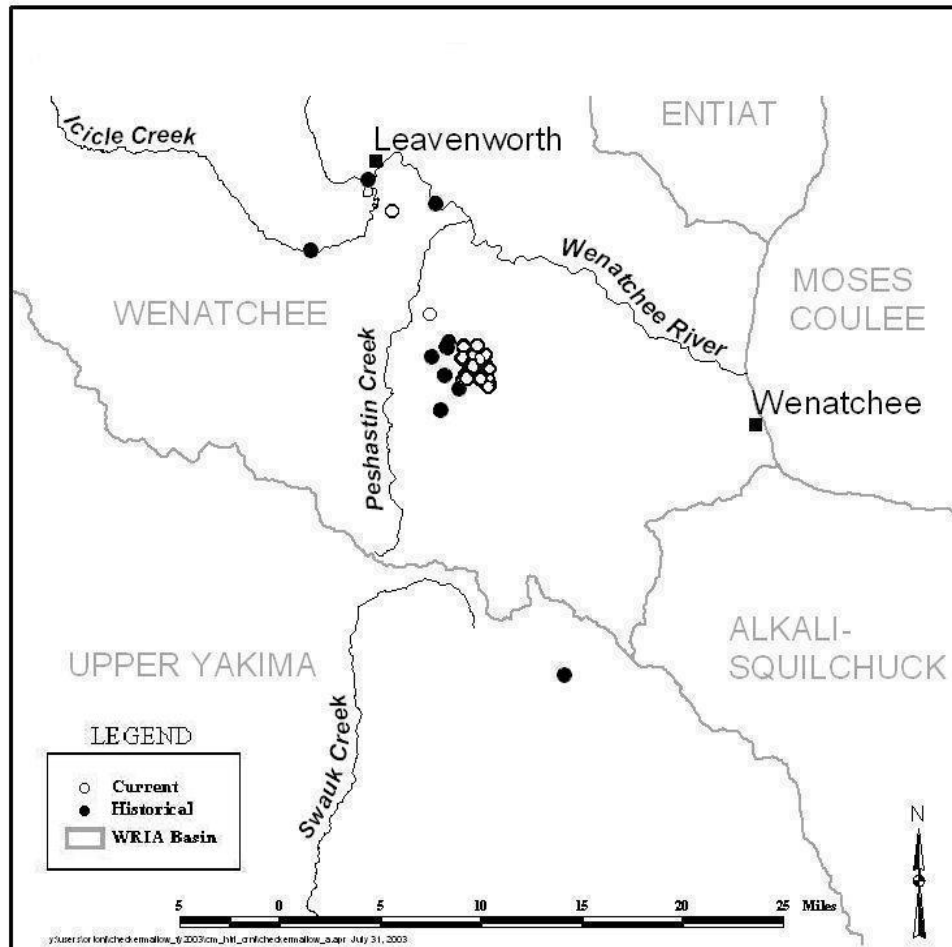


FIGURE 3. Map of current and historical occurrences of *Sidalcea oregana* var. *calva*, showing its distribution in the Icicle, Peshastin, and Swauk drainages. Note that most of the current occurrences are represented by a dense cluster of overlapping open circles within the Peshastin watershed. The larger hydrologic units shown are watershed resource inventory area (WRIA) basins. The Icicle and Peshastin watersheds are subunits of the Wenatchee basin, and the Swauk watershed is a subunit of the Upper Yakima basin.

location information or possibly because the plants have been extirpated in response to hydrological changes in the area (J. Gamon, pers. comm. 1997). Table 1 summarizes the population sizes, areas, population trends, and landownership for the remaining sites where this species is currently known to occur.

The wetland and moist meadow complex at Camas Meadows, an area managed as a Natural Area Preserve by the Washington Department of Natural

TABLE 1. Summary of known sites for *Sidalcea oregana* var. *calva*.

Site Name	Population Size (Survey Year)	Occupied Area	5-year Trend in Population Size	Landownership
Camas Meadows ¹	11,000 (2001)	14 to 20 hectares (35 to 50 acres)	stable	WDNR ² , WNF ² , private
Mountain Home ¹	300 (2001)	less than 0.4 hectares (less than 1 acre)	stable	private
Pendleton Canyon	160 (2001)	less than 0.4 hectares (less than 1 acre)	unknown; discovered in 1999	private
Camas Creek Tributary	8 (2001)	less than 0.4 hectares (less than 1 acre)	unknown; rediscovered in 2001	WDNR
Forest Service	43* (2001) *only 2 flowering adults	less than 0.4 hectares (less than 1 acre)	stable	WNF

¹ Portions of these populations are in the voluntary registry program administered by The Nature Conservancy and the Washington Department of Natural Resources.

² WDNR = Washington Department of Natural Resources; WNF = Wenatchee National Forest, Leavenworth Ranger District.

Resources, contains the largest known population of *S. oregana* var. *calva*. The Camas Meadow Natural Area Preserve includes approximately 535 hectares (1,337 acres) and is located in the rural/wildland interface about 16 kilometers (10 miles) south of Leavenworth, Washington. An estimated 11,000 individuals occur there, covering an approximate area of 14 to 20 hectares (35 to 50 acres) (D. Wilderman, pers. comm. 2003). Low-density, rural residential home sites have been developed adjacent to the Preserve. The Camas Meadows Bible Camp has occupied the southern perimeter of the meadow since the late 1940's, and the U.S. Forest Service administers properties surrounding the Preserve as well.

The next largest known populations occur on private lands. One population of about 300 individuals is located at the Mountain Home Resort. This population is disjunct from the others (more than 16 kilometers [10 miles] distant), and located in an area entirely surrounded with private residences, private timberlands, and a road administered by Chelan County. The population of *S. oregana* var. *calva* at this location is confined to a small linear area associated with a drainage ditch along a road. Due to its isolation and the marginal nature of this habitat, the final designation of critical habitat for *S. oregana* var. *calva* determined that this habitat was not essential to the conservation of the species (USFWS 2001). However, this population may represent a source of genetic variability for *S. oregana* var. *calva*, and therefore retains its importance as a potential source of seed for propagation and reintroduction efforts for the species.

The other privately-owned population is located in Pendleton Canyon, and consists of about 160 plants. This population is located less than 8 kilometers (5 miles) from the Camas Meadow population, and occurs in a relatively unmodified wildland setting.

The final two populations of *S. oregana* var. *calva* are very small. One, the Camas Creek Tributary site, is located north of the Camas Meadows Natural Area Preserve and is owned by the State of Washington. There are only eight plants at this site. The other population is found along the shoulder of a forest road within the Wenatchee National Forest (U.S. Forest Service). Although there

were 43 individuals present in 2001, only 2 of those 43 were reproductive adult plants (Caplow 2002).

In addition to the known population sites, areas not currently occupied by *S. oregana* var. *calva*, but which provide the physical and biological features required by the species, have been designated as critical habitat (see Critical Habitat, section E, below). These areas of suitable potential habitat will play an important role in the recovery of this species, as recovery will depend upon expanding the area occupied by the existing populations, where possible, and also potentially establishing new populations of the species through propagation and restoration efforts.

D. HABITAT DESCRIPTION

S. oregana var. *calva* is found between elevations ranging from 488 to 1,000 meters (1,600 to 3,300 feet) in the Wenatchee Mountains of Chelan County, Washington. The plant communities where the species is found are usually associated with meadows that have surface water or saturated upper soil profiles during spring and early summer. *S. oregana* var. *calva* may also be found in open conifer stands dominated by *Pinus ponderosa* (ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir), and on the margins of shrub and hardwood thickets when these areas are characterized by saturated soils that are maintained well into the early summer. Soils are primarily composed of silt loams and clay loams, with a high percentage content of organic material, that are poorly drained. *S. oregana* var. *calva* is generally found on flats or benches, but may also occur in small ravines and occasionally on gently sloping uplands.

Concentrations of *S. oregana* var. *calva* are found in the wetter portions of open forest-moist meadow habitats, in slight topographic depressions, on the perimeter of shrub and hardwood thickets dominated by *Populus tremuloides* (quaking aspen), and along permanent or intermittent streams in sparsely forested draws. Frequently associated species include *Populus tremuloides*, *Crataegus douglasii* (black hawthorn), *Symphoricarpos albus* (common snowberry), *Amelanchier alnifolia* (service berry), *Lathyrus pauciflorus* (few-flowered peavine), *Wyethia amplexicaulis* (northern mule's-ear), *Geranium viscosissimum*

(sticky purple geranium), *Polygonum bistortoides* (western bistort), *Aster foliaceus* (leafy aster), *Epilobium watsonii* (Watson's willow-herb), *Veratrum californica* (false hellebore), and *Rudbeckia occidentalis* (rudbeckia). A former Federal category 1 candidate plant species, *Delphinium viridescens* (Wenatchee larkspur), may be found in association with *S. oregana* var. *calva* as well.

In general, the maintenance of the natural hydrologic processes that provide the wetland and moist meadow habitats on which *S. oregana* var. *calva* depends is of critical importance in the conservation of this species. Additional information on the characteristics of important habitat for *S. oregana* var. *calva* is provided in the section on Critical Habitat below.

E. CRITICAL HABITAT

Critical habitat was designated on approximately 2,484 hectares (6,135 acres) of Federal, State, and private land in Chelan County, Washington (Figure 4). The final rule to designate critical habitat for *S. oregana* var. *calva* was published in the *Federal Register* on September 6, 2001 (USFWS 2001). The critical habitat designation included 831 hectares (2,051 acres) of Federal land, 578 hectares (1,428 acres) of local/State land, and 1,075 hectares (2,656 acres) of private land.

Critical habitat identifies specific areas that have the physical and biological features (primary constituent elements) that are essential to the conservation of a listed species and that may require special management considerations or protection. The primary constituent elements found in the areas designated as critical habitat for *S. oregana* var. *calva* include surface water or saturated upper soil profiles; a wetland community dominated by native grasses and forbs and generally free of woody shrubs and conifers that produce shade and competition for the species; seeps and springs on fine-textured soils (clay loams and silt loams), which contribute to the maintenance of hydrologic processes necessary to support meadows that remain moist into early summer; and elevations of 488 to 1,000 meters (1,600 to 3,300 feet).

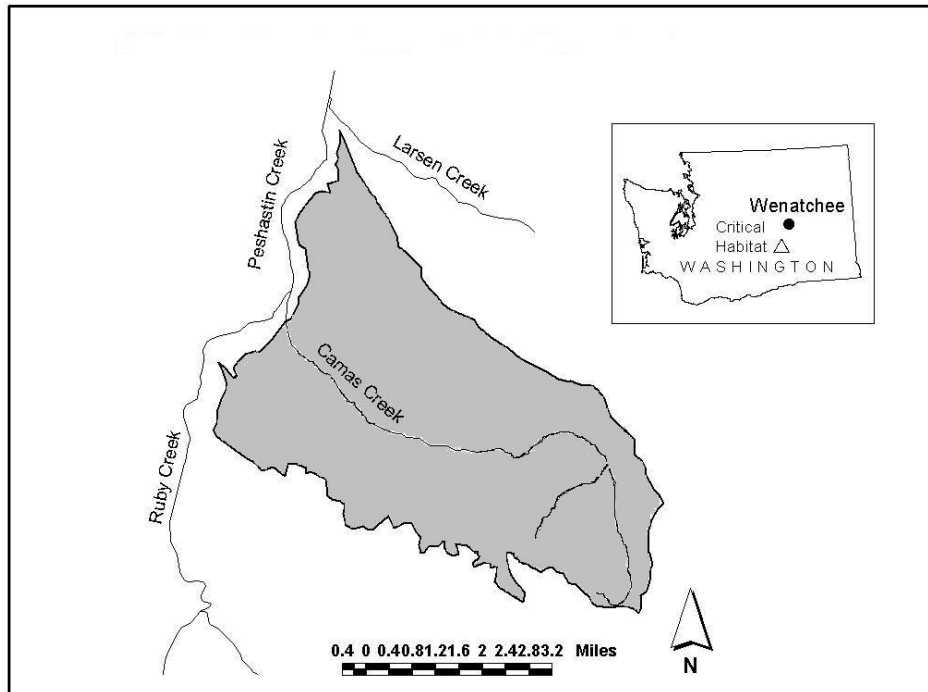


FIGURE 4. The shaded area represents those lands designated as critical habitat for *Sidalcea oregana* var. *calva* (USFWS 2001). As noted in the Final Rule, critical habitat does not include existing features and structures such as buildings, roads, lawns, residential landscaped areas, or other such areas that do not contain one or more of the primary constituent elements for the species.

Areas designated as critical habitat receive protection under section 7 of the Act through the prohibition against destruction or adverse modification of critical habitat with regard to actions carried out, funded, or authorized by a Federal agency. Federal agency consultations under section 7 of the Act do not apply to activities on private or other non-Federal lands that do not have a Federal nexus. The critical habitat designation does not afford any additional protections under the Act against such activities.

F. LIFE HISTORY AND ECOLOGY

S. oregana var. *calva* is a relatively long-lived herbaceous perennial. Plants have several stems and may grow as tall as 20 to 150 centimeters (8 to 60 inches). Vegetative stems are composed of several stalks with about one to three leaves each. Reproductive individuals produce flowers on one to several stems. Flowering begins in the middle of June and peaks in the middle to end of July, although some individuals may have flowers present in mid-August. Well-developed fruits are present by early August (Hitchcock *et al.* 1961; Washington Natural Heritage Program and U.S. Bureau of Land Management 1998). The species reproduces only from seed and, based on examination of seed capsules, the production of seed appears to be high (Gamon 1987). The somewhat clumped distribution of mature *S. oregana* var. *calva* plants suggests that seed dispersal is restricted to the areas near mature plants, unless the seeds are moved by animals or transported by water (Caplow 2002).

Pollination of the species is not well understood. In her studies of *S. oregana* var. *calva*, Goldsmith (2003) reported that the colonial ground-nesting bee *Diadasia nigrifrons* is most likely the dominant pollinating insect. Honey bees (*Apis mellifera*), although present, were not observed to visit *S. oregana* var. *calva*. Interestingly, Goldsmith found no significant difference in the rate of flower to fruit success (about 36 percent) between flowers that were excluded from insect pollination and those that were not, indicating that insects are not the sole vector for pollination. Goldsmith pointed to the need for further study of the pollination mechanisms of *S. oregana* var. *calva* to potentially improve the plant's reproductive output.

High levels of seed predation by weevils (insect family Curculionidae) had formerly been reported as a potential threat to *S. oregana* var. *calva* (Gamon 1987; L. Malmquist, pers. comm. 2001), and the studies of Goldsmith (2003) support these observations. Of all seeds counted, Goldsmith found that from 62 to 78 percent had been damaged by weevils (*Macrorhoptus niger*). She speculates that this level of seed predation probably has a substantial negative impact on the reproductive output of *S. oregana* var. *calva*. Whether sublethal damage to the seeds may potentially benefit germination (*e.g.*, by breaking the

seed coat) is unknown. Between her studies of weevil predation and potential pollination mechanisms, Goldsmith reports that of the four sites where she studied *S. oregana* var. *calva*, none had greater than 25 percent seed survival over the 2 years of her study, potentially limiting seedling recruitment and population growth for the species.

Fire may play a role in the maintenance of suitable habitat for *S. oregana* var. *calva* (Gamon 1987). Historically (prior to 1900), fire frequency in the forests east of the Cascade Crest was approximately every 13 years (Everett *et al.* 1997). Occasional fires could potentially benefit the species by maintaining the open habitats with high moisture levels that it prefers. In the absence of fire, succession and woody plant invasion increase competition for light, nutrients, and water. The increased density of woody vegetation would also adversely impact habitat suitability by reducing the surface runoff within the small wetlands where *S. oregana* var. *calva* occurs.

Goldsmith (2003) attempted to assess the response of *S. oregana* var. *calva* to fire by comparing numbers of plants in plots subjected to controlled burns with plants in untreated plots. The numbers of plants and various measures of size and cover were assessed 9 months after a controlled burn conducted in mid-October, a time when most of the plants have naturally died back due to frost. Unfortunately her results were confounded by a severe drought during one of the two seasons of data collection, preventing statistically strong treatment effects, but Goldsmith did observe that *S. oregana* var. *calva* on both the burned and unburned plots responded with relatively vigorous and lush growth during the year that precipitation levels were normal.

S. oregana var. *calva* appears to be more resilient to ground disturbance than previously believed. The Mountain Home Meadow site was adversely impacted by fire-suppression activities associated with the Rat Creek Fire during 1994 (Harrod 1995). A fire safety area was constructed in the drainage area supporting a population of *S. oregana* var. *calva*. Blading of the area by a bulldozer destroyed approximately 50 percent of the population (more than 100 plants), disturbed the soil, and altered the hydrology of this wet meadow. One year after the disturbance, no *S. oregana* var. *calva* plants were observed at this

location (T. Thomas, pers. obs. 1995), and the likelihood of recovery within the disturbed portion of the population was originally considered to be unlikely (R. Harrod, pers. comm. 1996). By spring 2001, however, much of this drainage area had become repopulated with *S. oregana* var. *calva* from seed disseminated from residual plants.

Germination studies of *S. oregana* var. *calva* conducted at the Berry Botanic Garden were unsuccessful. Seeds were subjected to 8 weeks of cold stratification or no cold stratification, but no germination resulted under any of the test conditions. It is not known whether the conditions for germination were not met or if the seed was not viable (Center for Plant Conservation 2003). Germination of *S. oregana* var. *calva* was successfully achieved, however, by a student at the University of Washington (Huseby 2000). Priya Huseby compared the results of nine different treatments on seeds of *S. oregana* var. *calva*, including various combinations of scarification and cold stratification; all seeds were soaked in water for 24 hours. Although germination was achieved under six of the nine test conditions, only one seedling emerged from those treatments without cold stratification. Seedlings were successfully produced from seeds that received 1.5 months of cold stratification, but germination was greater still and occurred more quickly in those seeds that were subjected to 3 months of cold stratification. An increased period of cold stratification therefore appears to increase germination of *S. oregana* var. *calva*. Scarification of the seed coat did not appear to influence germination, however the researcher noted the need for further study in this regard.

Our present knowledge of the biology of *S. oregana* var. *calva* is limited. Research to gather key information such as the population data needed for assessing population viability will be a key component of the recovery strategy for this species.

G. THREATS AND REASONS FOR LISTING

Section 4(a)(1) of the Endangered Species Act specifies that species may be determined to be threatened or endangered due to one or more of the five factors listed below, all of which apply to *S. oregana* var. *calva*. Removal of

these reasons for listing is the ultimate criterion for recovery and delisting, as described in Part II of this plan. Additional details about the reasons for listing can be found in the Final Listing Rule (USFWS 1999).

1. The present or threatened destruction, modification, or curtailment of its habitat or range

All known sites and habitats for *S. oregana* var. *calva* have undergone various alterations. Conversion of land to orchards or other agricultural uses and rural residential development is thought to have extirpated historical populations (Gamon 1987). Habitat for this species may be degraded or destroyed by residential or agricultural development through modifications such as alterations in hydrology, increased nutrient loads from septic systems, introduction of nonnative grasses, conversion of meadows to agricultural uses including pasture land and gardens, and road construction (Gamon 1987; T. Thomas, pers. obs. 1995; D. Wilderman, pers. comm. 1997).

Altered hydrology is one of the primary threats to this species. At Camas Meadows, for example, natural drainage channels have been altered to direct water away from the primary wet meadow area for agricultural purposes (Gamon 1987; R. Harrod, pers. comm. 1996; D. Wilderman, pers. comm. 1997). Alterations in hydrology threaten the species by changing the amount, timing, duration, and/or frequency of the water supply to its wetland habitat. Most individuals of *S. oregana* var. *calva* at Camas Meadows are associated with the drainage channels or areas that retain moisture relatively longer (Gamon 1987). Activities such as road construction and timber harvesting may also alter hydrology by modifying surface and subsurface runoff, changing water flows, and increasing the potential for erosion and sedimentation.

Fire suppression is both a direct and indirect source of habitat degradation or loss for *S. oregana* var. *calva*. As described under Life History (above), in the absence of fire to set back succession, woody plants begin to encroach upon the moist mountain meadows preferred by this species, altering the hydrology and availability of sunlight and nutrients. Fire suppression has probably resulted in less suitable habitat for this species (R. Harrod, pers. comm. 1996), and as fires

threatening private property and public structures are suppressed, the likelihood for further negative impacts through habitat succession remains high.

Fire suppression activities may also result in direct mortality to substantial numbers of *S. oregana* var. *calva*. In the course of constructing a fire safety zone in Camas Meadows during the Rat Creek and Hatchery Creek fires in fall of 1994, a bulldozer inadvertently destroyed several hundred *S. oregana* var. *calva* plants (Harrod 1995; T. Thomas, pers. obs. 1995). The plants were bladed and uprooted, the topsoil removed, and the site scraped to mineral soil. During a visit to the disturbed site in May of 1995, researchers observed no sprouts or seedlings of *S. oregana* var. *calva* (T. Thomas, pers. obs. 1995). Our experience with the rapid recovery of the wet meadow at the Mountain Home site following a similar event indicates that this small drainage will probably recover. However, a small population of *S. oregana* var. *calva* may not be capable of rebounding from such an incident if no residual plants were left as a seed source.

The introduction of nonnative plants, and particularly grasses, may pose a threat to *S. oregana* var. *calva* through competition. Many introduced grasses are rhizomatous (forming a thick layer of matted roots) and tend to outcompete native species for nutrients and water, therefore displacing native species (R. Harrod, pers. comm. 1996). Portions of the primary meadow at Camas Meadows have been seeded to nonnative grasses to increase forage for livestock. In addition, nonnative grasses have been planted near residences for lawns and appear to be encroaching into the primary meadow area (T. Thomas, pers. obs. 1995). *S. oregana* var. *calva* is generally absent from these areas except for occasional individuals along the periphery, suggesting that the introduced species are able to displace *S. oregana* var. *calva* (Gamon 1987).

The presence of livestock may also alter the wetland meadow habitats of *S. oregana* var. *calva*. Domestic stock such as sheep, horses, and cows trample vegetation, compact soils, and serve as vectors for introducing nonnative plant seeds either directly or indirectly through their feed. Livestock, especially sheep, have grazed the meadow complex at Camas Meadows, and the southeast portion of the meadow is currently grazed by horses.

Timber harvest may have long-term effects on hydrologic function and poses a threat to *S. oregana* var. *calva* by increasing erosion and sedimentation in the wetlands where it occurs and changing the patterns of surface and subsurface water runoff. The direct impacts of timber harvest operations may pose a greater threat than tree removal, however, as local ground disturbance activities such as log yarding or slash disposal may crush plants and compact the soil (Gamon 1987). Timber harvest has occurred throughout the general Camas Meadows area (R. Harrod, pers. comm. 1996), and several of the other populations occur in areas that are not protected from timber harvest.

2. Overutilization for commercial, recreational, scientific, or educational purposes

Seeds of the full species *Sidalcea oregana* are collected by horticulturists. Some populations are small enough that even limited collecting pressure could have adverse impacts. *S. oregana* var. *calva* is an attractive plant and may be sought for collection. All perennial species in the genus are considered attractive plants with horticultural potential (Hitchcock and Cronquist 1961; Gamon 1987). Wild-collected seed of the species *S. oregana* (no variety given) is available through a seed exchange program offered by the International Gardening Society, North American Rock Garden Society (North American Rock Garden Society 1996). Although seed collection does not pose a key threat to *S. oregana* var. *calva* currently, the potential of harm through such activity should be considered when developing management plans for the species.

3. Disease or predation

Large numbers of aphids have infested individuals of *S. oregana* var. *calva* at the Camas Meadows and Mountain Home Meadow populations (Gamon 1987). The effect of these aphids, or the relationship of the aphids to *S. oregana* var. *calva*, is not known. In 1987, 2000, and 2001, researchers observed that weevils had eaten the majority of the seeds that had been produced (Gamon 1987; L. Malmquist, pers. comm. 2001). A recent study verified that loss of *S. oregana* var. *calva* seeds due to weevil predation is very high, and may have substantial negative impacts on the reproductive capacity of the plant (Goldsmith 2003).

Some grazing by horses and wildlife (deer and elk) has been observed in areas occupied by *S. oregana* var. *calva*. However, the impact from grazing livestock or wildlife is unknown (Gamon 1987; R. Harrod, pers. comm. 1996).

4. The inadequacy of existing regulatory mechanisms

S. oregana var. *calva* is included on the U.S. Department of Agriculture Forest Service (Forest Service) Region 6 Sensitive Plant List and is listed as endangered by the Washington Department of Natural Resources (Washington Natural Heritage Program 1997). The State of Washington has no State Endangered Species Act, therefore the Washington Department of Natural Resources designation provides no legal protection for this species.

The wetland habitat of *S. oregana* var. *calva* is under the jurisdiction of the U.S. Army Corps of Engineers, which regulates the discharge of dredged or fill material into waters of the United States, including wetlands, under section 404 of the Clean Water Act (33 USC 1251 *et seq.*). Project proponents are required to obtain a permit from the U.S. Army Corps of Engineers prior to undertaking activities (*e.g.*, grading, discharge of soil or other fill material) that would result in the fill of wetlands under the U.S. Army Corps of Engineers' jurisdiction. Generally, if a project falls below certain thresholds, such as the fill of wetlands less than 0.13 hectares (0.33 acres) under Nationwide Permit 26 (33 Code of Federal Regulations 330.5(a)(26)), the project is considered authorized. Projects meeting the criteria for a nationwide permit are normally permitted with minimal environmental review by the U.S. Army Corps of Engineers.

Individual permits are required for the discharge of fill material into wetlands above the thresholds established by the nationwide permits. The review process for the issuance of individual permits is more rigorous than for nationwide permits. In practice, the U.S. Army Corps of Engineers rarely requires an individual permit when a project would qualify for a nationwide permit, unless the project has substantial or more than minimal impacts, if a species is federally listed as threatened or endangered, or other significant resources might be adversely affected by the proposed activity.

All but one of the five populations of *S. oregana* var. *calva* are less than 0.4 hectares (1 acre) in size. These populations could be severely affected by even a small discharge of fill or dredged material, and any of the smaller populations could be eliminated by wetland fill or discharged material. Because many activities that could cause modification or destruction of the wetland habitats of *S. oregana* var. *calva* may be authorized by a nationwide permit, section 404 of the Clean Water Act provides insufficient protection of the species.

5. Other natural or manmade factors affecting its continued existence

When populations reach low numbers of individuals, their vulnerability to extirpation from human-caused and random events increases (Gilpin and Soulé 1986; Schemske *et al.* 1994; Given 1995). Small populations may lose a large amount of genetic variability because of genetic drift and, therefore, have a reduced likelihood of long-term viability (Soulé 1980). Two of the extant populations of *S. oregana* var. *calva* have fewer than 10 reproductive individuals. The numbers of plants are so low in these populations that they may not be viable, and little opportunity exists for genetic exchange with other populations. In addition, the area where these populations occur are designated under the Northwest Forest Plan as matrix (U.S. Department of Agriculture and U.S. Department of the Interior 1994a,b), which is land that is available for timber harvest. The Mountain Home Meadow population and the Pendleton Canyon population each have 300 or fewer plants and are vulnerable to many of these same threats.

Population sizes are so low at most of the known sites of *S. oregana* var. *calva* that the majority of these are highly vulnerable to extirpation by random natural events such as wildfire. The potential for forest fires is high in the east side ponderosa pine and Douglas-fir forest type. Prior to 1900, historical fires occurred in this region on a cycle of roughly 13 years, with fire essentially absent from 1900 to 1990 due to suppression (Everett *et al.* 1997). With the reduction of fires during this century, the structure of east-side forests has been altered with an increase in tree density and development into multiple canopy layers. Because of the changes in stand structure, these forests are highly susceptible to wildfire (Agee 1993). Although *S. oregana* var. *calva* may benefit from occasional fires

to set back succession, a wildfire during the growing season of the plant could have highly negative consequences.

The presence of an adjacent gravel road is an additional threat to the Mountain Home population, the Pendleton Canyon population, and portions of the Camas Meadows population. Dust from the road may hinder pollination of the plants nearest the road (Gamon 1987).

Recreational usage poses a threat to some of the populations. People engaging in a variety of recreational activities, including trail bike riding, bowhunting competitions, and camping, contribute to the species' decline by trampling plants and compacting the soil. Trampling of *S. oregana* var. *calva* plants has been documented (D. Wilderman, pers. comm. 1997), and usage of the primary meadow in Camas Meadows has had detrimental effects on the population of *S. oregana* var. *calva* there (Gamon 1987; D. Wilderman, pers. comm. 1997).

H. CONSERVATION MEASURES

1. Protections under the Endangered Species Act

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain activities. The Act provides for possible land acquisition and cooperation with the States and requires that recovery actions be carried out for all listed species. Funding may be available through section 6 of the Act for the State to conduct recovery activities.

Section 7 of the Act requires Federal agencies to evaluate their actions with respect to any species that is listed as endangered or threatened, and its critical habitat, to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. One of the five known populations of *S. oregana* var. *calva* is found entirely on Federal lands managed by the Wenatchee National Forest, while a second population lies partially within its boundaries. The U.S. Forest Service would be required to consult with us if any actions such

as timber harvesting, road construction, grazing, or fire suppression and fire management activities may affect *S. oregana* var. *calva* or its critical habitat. Other Federal agency actions that may require consultation include the U.S. Army Corps of Engineers' authorization of projects affecting wetlands and other waters under section 404 of the Clean Water Act, Environmental Protection Agency authorization of discharges under the National Pollutant Discharge Elimination System, Natural Resource Conservation Service projects, and Department of Housing and Urban Development and Veterans Administration mortgage programs (Federal Home Administration loans). The Act also requires Federal agencies to use their authorities to carry out conservation programs for endangered and threatened species.

General prohibitions and exceptions that apply to all endangered plants under the Act include all trade prohibitions of section 9(a)(2). These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to import or export, transport in interstate or foreign commerce in the course of a commercial activity, sell or offer for sale in interstate or foreign commerce, or remove such plants from areas under Federal jurisdiction. In addition, the Act prohibits the malicious damage or destruction of listed plant species on areas under Federal jurisdiction and the removal, cutting, digging up, damaging, or destroying of such plants in knowing violation of any State law or regulation, or in the course of a violation of State criminal trespass law. Certain exceptions to the prohibitions apply to U.S. Fish and Wildlife Service agents and State conservation agencies. The Act also provides for the issuance of permits to carry out otherwise prohibited activities involving endangered plant species under certain circumstances. Such permits are available for scientific purposes and to enhance the propagation or survival of the species. Few trade permits are likely to be sought or issued because the species is not common in cultivation or in the wild.

Collection, damage, or destruction of this species on Federal lands is prohibited, although in appropriate cases a Federal permit could be issued to allow collection for scientific or recovery purposes. Such activities on non-Federal land would constitute a violation of section 9 of the Act if activities were conducted in knowing violation of Washington State law or regulations, or in the course of a violation of Washington State criminal trespass law.

2. Other Conservation Measures

The largest known population of *S. oregana* var. *calva* is found at Camas Meadows, and about 75 percent of that population occurs within the boundaries of the Camas Meadows Natural Area Preserve. This preserve is one of nearly 50 such sites protected in Washington's Natural Area Preserve System, owned by the State and managed by the Department of Natural Resources. Natural Area Preserves are designed to protect the highest quality examples of native ecosystems and rare plant and animal species in the State, and may be used for education and scientific research in addition to preserving native biological diversity. The Washington Department of Natural Resources completed a management plan for the Camas Meadows Natural Area Preserve in February 2000, and this plan includes management objectives and guidelines for the population of *S. oregana* var. *calva* that occurs there.

Some limited monitoring of *S. oregana* var. *calva* populations has taken place on a relatively consistent basis since 1998. Six transects with tagged individual plants have been counted on an annual basis; four of these transects are on the Camas Meadows Natural Area Preserve, and two are on Forest Service lands. Lauri Malmquist of the Wenatchee National Forest has been in charge of the data collection for these transects. In addition, baseline data has been collected and there has been some experimentation with mowing and other forms of treatment on *S. oregana* var. *calva* at the Camas Meadow Natural Area Preserve (D. Wilderman, pers. comm. 2003).

Mountain Home and a portion of the Camas Meadows population are a part of the voluntary registry program administered by The Nature Conservancy and the Washington Department of Natural Resources (Caplow 2002). Although this program does not provide any specific protection to the plants, it does allow access to the properties for the purposes of monitoring the populations.

I. CONSIDERATION OF PROPOSED AND CANDIDATE SPECIES, AND SPECIES OF CONCERN

The Wenatchee National Forest has developed a draft conservation agreement with us for another sensitive plant species, *Delphinium viridescens*

(Wenatchee larkspur), a former Federal category 1 candidate plant species that remains a species of concern. The draft conservation agreement would indirectly provide some measures for conserving *Sidalcea oregana* var. *calva* at the site where the two species occur together, the Camas Meadows Natural Area Preserve. Some of the protective mechanisms discussed in the draft agreement have been implemented and may serve to promote the recovery of *S. oregana* var. *calva* on Forest Service land. However, this agreement has not been finalized, does not address all of the threats to *S. oregana* var. *calva*, and is inadequate to protect and recover the species throughout its range (Gamon 1987; J. Gamon, pers. comm. 1997). Protection provided through this conservation agreement would not extend to private or State owned land, where many of the individual plants occur.

J. RECOVERY STRATEGY

The first step toward recovery of *S. oregana* var. *calva* is to protect and manage the known populations. On public lands, we will work with the Washington Department of Natural Resources Natural Areas Program and the Forest Service. The populations on the two privately owned lands will need protection through a combination of mechanisms including possible acquisition from willing sellers, conservation easements, management agreements, voluntary protection, or other approaches.

Maintaining the known populations will depend on developing successful partnerships with public land managers and private landowners. It will also require gaining knowledge about how the ecosystem functions where *S. oregana* var. *calva* is found. Some active management will be required for each of the locations to maintain or enhance the populations. Management actions must be designed to eliminate or reduce the threats identified for this species in order to ensure its long-term viability.

Recovery requires increasing the area occupied by existing populations where space and habitat allow, as well as possibly establishing new populations. The first step in this process is to evaluate the feasibility and propriety of expanding existing populations and establishing new populations, as well as identifying the sites appropriate for these activities.

Another feature of recovery is continued survey effort. Small, isolated populations of *S. oregana* var. *calva* have been discovered in the past 3 years. Additional populations that are not visible from any public access points may be present on privately owned land that has not been surveyed. One strategy to improve the efficiency of continued survey efforts is to prepare and make available informational materials that will enable the public to recognize the species and appreciate its significance.

Research and monitoring are also key components of the recovery strategy. Research will need to focus efforts on: (1) maintaining and enhancing populations at existing locations; and (2) establishing and maintaining new, viable populations at appropriate sites. Basic research on the biology and ecology of *S. oregana* var. *calva* is limited and will require funding. Research and available information on the establishment of new populations is mostly lacking. To recover the species, research will need to be designed to provide new information in both areas.

II. RECOVERY

A. RECOVERY OBJECTIVES

The ultimate objective of this recovery plan is to outline recovery actions that, when implemented, will remove threats to *S. oregana* var. *calva* to the extent that it is no longer in danger of extinction. At that point, removal of *S. oregana* var. *calva* from the Federal List of Endangered and Threatened Wildlife and Plants (delisting) may be warranted. The interim objective is to stabilize the existing populations and accomplish increases in population sizes and geographic distribution across the historical range of the species sufficient to consider reclassification or downlisting of *S. oregana* var. *calva* to threatened status.

In the Final Rule to list *S. oregana* var. *calva* as an endangered species (USFWS 1999), we identified several key threats that must be adequately addressed before reclassification of the species to threatened status or delisting can be considered. Appendix A links recovery criteria to the five listing factors

and the recovery actions. These “Threats and Reasons for Listing” are also discussed in Part I of this recovery plan.

B. RECOVERY CRITERIA

Downlisting Criteria. Downlisting will be considered when all of the following conditions have been met:

1. There are at least three stable, self-sustaining populations in each of the three 5th field watersheds (Peshastin, Icicle, and Swauk) where the species historically occurred or currently occurs. Alternatively, there could be four stable, self-sustaining populations in two of the 5th field watersheds within the historical or current range of the species.

Additional populations may be identified through additional surveys or established through reintroductions. To be considered stable and self-sustaining, a population should maintain a 5-year average of at least 500 adult plants, show evidence of positive or neutral population growth over the same 5-year period, and show evidence of natural reproduction and establishment.

2. All of the stable, self-sustaining populations are on protected sites secure from threats. For a site to be considered protected, it must be owned or managed by a government agency or private conservation organization that identifies maintenance of the species as the primary management objective for the site, or the site must be protected by a permanent conservation easement or covenant that commits present and future landowners to the conservation of the species.

3. Genetic material is stored in a facility approved by the Center for Plant Conservation. The stored genetic material in the form of seeds must adequately represent the species’ geographic distribution and genetic diversity.

4. Adequate population and habitat monitoring has been established for all of the species’ populations. Population monitoring must be statistically sound and should be able to detect a 20 percent change in the

population with a 90 percent degree of certainty. Habitat monitoring should include monitoring of shrub and tree cover, nonnative species, and hydrology.

5. Management plans have been developed and implemented for all State and federally owned populations. Management plans will include provisions for habitat maintenance and restoration, monitoring, and research, and will define actions designed to reduce or control threats to the species such as noxious weed control and fire management.

Delisting Criteria. The criteria for delisting the species remains the same as the criteria for downlisting, with the following additions:

1. The populations that meet downlisting criterion #1 above will be naturally reproducing, stable or increasing in number with a minimum of 500 adult plants, secure from threats, and will have persisted at that level for an additional 5 years, for a total of 10 years. All other details of criterion #1 remain unchanged.

2 through 5. Remain the same.

6. Post-delisting monitoring plans and agreements to continue post-delisting monitoring are in place and ready for implementation at the time of delisting. Monitoring of populations following delisting will verify the ongoing recovery of the species and provide a means of assessing the continuing effectiveness of management actions.

Due to our limited knowledge of the biology of this species at this time, more specific downlisting or delisting criteria may be developed as new population status and life history information is collected during the course of research and management activities.

C. NARRATIVE OUTLINE OF RECOVERY ACTIONS

1. Maintain the current geographic distribution of the species.

The current geographic distribution of the species must be maintained by maintaining habitat integrity. There are only five known populations of *S. oregana* var. *calva*. All of the populations are composed of 300 or fewer plants, with the exception of the Camas Meadows population, which is estimated to be over 11,000 plants (D. Wilderman, pers. comm. 2003 [unpublished data]). The current populations are within the Peshastin and Icicle Creek watersheds. The Camas Meadows population is on private, State, and Federal land. One population is entirely on Forest Service land, one is on State land, and the two remaining populations are on private land.

1.1 Develop and implement habitat management plans on Federal and State managed lands.

Successful management on these lands will be critical to the success of the recovery efforts. Current management activities, as well as threats, vary from site to site, so each site must have an individualized management plan. These plans should include provisions for the management of the sites with the best potential for providing long-term stable habitat, and maintenance of unoccupied, potential habitat in suitable condition, since such areas represent sites for potential future colonization.

1.1.1 Periodically review the Camas Meadows Natural Area Preserve management plan (Priority 2).

A management plan for the Washington Department of Natural Resources Camas Meadows Natural Area Preserve was completed in February 2000, and contains management objectives and guidelines for the largest known population of *S. oregana* var. *calva*. These should be reviewed and updated annually, and the management plan should be updated in its entirety as necessary.

1.1.2 Develop a management plan for the U.S. Forest Service portion of Camas Meadows (Priority 1).

Although the U.S. Forest Service has been active in research and management of their portions of the Camas Meadows population, a written management plan would help guide the management process.

1.1.3 Coordinate between U.S. Forest Service and Washington Department of Natural Resources in the management of Camas Meadows (Priority 1).

The Camas Meadows area is a complex, hydrologically connected area. Coordination between the two primary land managers is essential to good management. Management plans should be coordinated, and the agencies should meet annually or biannually to compare work and issues.

1.1.4 Develop management plans for all other Washington Department of Natural Resources and U.S. Forest Service populations (Priority 1).

At this time there are two other small populations that occur on public lands: the Camas Creek Tributary site, owned by the Washington Department of Natural Resources, and one population within the Wenatchee National Forest (U.S. Forest Service). Each of these populations numbers 10 or fewer reproductive individuals. Simple management plans should be developed for these populations, and if other populations are found on State or Federal land, a management plan should be developed and implemented immediately.

1.2 Develop and implement monitoring plans for all known populations to assess trends and monitor threats (Priority 2).

There are several monitoring projects in place, but they are not specifically designed to assess trends. Successful management of individual populations will depend on the ability to detect long-

term changes in the population or its habitat, and to make specific management decisions based upon those changes. Monitoring of population characteristics, such as distribution, density, rate of reproduction, and establishment, is the most powerful method of assessing population trends. If possible, some of the monitoring should include these population characteristics, as this will provide the data needed for estimating viable population sizes. For practical reasons it may be necessary to have less time-intensive monitoring for some populations. If possible, monitoring should include the populations on private land.

1.3 Promote protection of key occurrences on private land.

One of the populations on private land is the only known population in the Icicle Creek watershed. Another is the only known population in its subwatershed. Protecting these populations is a high priority in the recovery of the species.

1.3.1 Develop site-specific management recommendations for landowners (Priority 1).

The habitat of *S. oregana* var. *calva* is seral and subject to change through invasion by trees and shrubs. Hydrology is also a critical component of the environmental parameters for the species. Without active management, populations on private lands are likely to decline. Written site-specific management recommendations and support for landowners increase the likelihood that these populations will remain viable.

1.3.2 Develop protection on private land (Priority 2).

Unprotected populations on private land are inherently vulnerable and cannot be used to meet the criteria for this recovery plan. The highest level of protection agreeable to landowners should be obtained. Land purchase from willing sellers, conservation easements, or conservation

agreements are possible approaches for protecting populations on private land.

2. Identify and map all populations and identify potential habitat for reintroductions.

Although considerable inventory work has been undertaken for this species, the discovery in the last few years of previously unknown sites, and the highly convoluted terrain of the Wenatchee Mountains, suggests that other populations may yet be discovered.

2.1 Characterize and model habitat requirements (Priority 2).

Understanding the habitat requirements (soil texture, chemistry, moisture, associated species, woody cover, hydrology) of the known populations is the first step in the identification of possible reintroduction sites, and is also important in the proper management of the known populations.

2.1.1 Analyze existing data (Priority 2).

Data have been gathered on many of the habitat requirements above, but little analysis has been done. The analysis of the existing data and the identification of further characterization work is an important first step.

2.1.2 Collect and analyze additional data (Priority 2).

After the existing data have been analyzed, there may be further field work and data analysis needed to refine the model of the habitat requirements for *S. oregana* var. *calva*.

2.2 Conduct geographic information systems (GIS) based research to identify potential habitat in Peshastin, Icicle, and Swauk watersheds (Priority 2).

There are both current and historical records from the Peshastin and Icicle watersheds, and there is one historical collection from the Swauk watershed. Potential habitat could be identified using soil, slope, elevation, and vegetative cover characteristics of the

known populations, and applying these characteristics to a geographic information systems based search of the watersheds.

2.3 Conduct field investigations of potential habitat (Priority 2).

The maps of potential habitat developed through geographic information systems based searches would be used as the basis for field investigations in the Peshastin, Icicle, and Swauk watersheds, using standardized rare plant search methods developed by us or other natural resource management agencies. Field searches may identify new populations or areas for potential reintroductions.

2.4 Map all populations with Global Positioning Systems (GPS) (Priority 2).

All populations should be mapped at the highest possible degree of accuracy using global positioning systems technology.

2.5 Create a spatial database for survey results, including negative searches (Priority 3).

In order to complete surveys for the species before moving toward reintroduction, a systematic approach and protocol for information management should be developed.

3. Conduct research and monitoring essential for the conservation of the species.

Research is needed to guide successful management of existing populations and make possible the establishment and maintenance of new populations. Our ability to effectively manage for the recovery of this species is presently limited by critical data gaps in our knowledge of the life history and ecology of *S. oregana* var. *calva* and the dynamic processes that maintain its wetland habitat.

3.1 Conduct an annual weed inventory and implement control measures (Priority 2).

Noxious weeds, including introduced grasses, pose a significant threat to some populations of *S. oregana* var. *calva*. Annual inventory of all populations will encourage the early detection and control of weed infestations.

3.2 Study the effects of seed predation by weevils (Priority 2).

Weevil seed predation has been widely observed (e.g., Caplow 2002; Goldsmith 2003), and may be a significant factor in the suppression of seed production in *S. oregana* var. *calva*. Experimental weevil exclusion and the development of a quantitative method to assess the annual severity of weevil infestations would provide more information on the significance of weevils in the recovery of the species.

3.3 Study the effects of fire and woody cover removal on population dynamics (Priority 2).

Fire may have played an historical role in the maintenance of habitat for this species. However, fire suppression over the last century has resulted in significant changes to habitats, and species composition has been particularly affected. When plants have evolved in fire-adapted systems, fire can often be used to enhance populations. However, the critical time of year, level of severity, and fire return interval all need to be established. In the absence of fire as a management tool, the manual removal of woody cover may be appropriate, but again, further research is needed on the effects of woody cover removal and the proper methods and timing.

3.4 Identify and study pollinators (Priority 2).

The presence and density of suitable pollinators may be significant for the viability of current populations and the suitability of potential reintroduction sites. Knowledge of pollinators and their dispersal capabilities will also assist in determining the requisite

proximity of populations to ensure cross-pollination and gene flow. A recent study provides some clues to the identity of the most likely pollinators (Goldsmith 2003), but also stresses the importance of further research in this area for the successful conservation of *S. oregana* var. *calva*.

3.5 Develop a model to predict annual reproductive success (Priority 3).

There appears to be wide annual variation in the reproductive success of *S. oregana* var. *calva*, particularly in the development of viable seed. If years of poor reproduction can be correlated to annual variation in precipitation or other climatic factors, it may be possible to distinguish between natural fluctuations and declines from other causes.

3.6 Study the effects of ground disturbance on population dynamics (Priority 3).

Some observers have noted that *S. oregana* var. *calva* may have responded positively to ground disturbance experienced in the course of fire suppression activities. Identifying the effects of different degrees of ground disturbance will be of benefit in the development of effective management plans.

3.7 Determine how to quickly establish viable populations (Priority 3).

Experiments are necessary to develop efficient, effective techniques for establishing *S. oregana* var. *calva* in the field. Methods for preparing sites, preparing and growing seed, and growing and setting out plants need to be considered and tested.

4. Develop and implement a reintroduction plan to establish new populations within the historical range of the species.

Further field inventory may reveal previously unknown populations that meet the criteria for recovery. If so, reintroduction efforts will not be necessary. However, if no other large populations are found through

further surveys, reintroduction may be necessary for the recovery of the species. A carefully prepared reintroduction plan and research to develop propagation and reintroduction protocols will be necessary before reintroduction is undertaken. Reintroduction may only take place in watersheds that currently support or once supported populations based on historical collections.

4.1 Develop a reintroduction plan (Priority 3).

Many factors need to be evaluated before reintroduction is undertaken. These factors include: (1) the goals of the reintroduction effort; (2) where it will take place; (3) who will maintain and manage the populations(s); (4) how, from a biological perspective, the effort should be conceived and carried out; and (5) whether reintroduction is technically feasible.

4.2 Implement the reintroduction plan (Priority 3).

If necessary for the recovery of *S. oregana* var. *calva*, the reintroduction plan should be fully implemented.

5. Establish a technical working group (Priority 3).

Individuals with expert knowledge of the biology of *S. oregana* var. *calva* and the ecosystem on which it depends will be asked to assess the progress of recovery efforts. Annual review of all progress toward recovery and all ongoing research and monitoring is critical for successful implementation of this recovery plan.

6. Collect seed from all source populations to represent the range of genetic diversity within the species' range and store the seed in a facility approved by the Center for Plant Conservation (Priority 3).

The small number of known populations, the narrow range of the species, and the small number of individuals in each population make the species vulnerable to random environmental and human-caused events. To hedge against the loss of significant genetic material, seed representing the diversity within the species should be collected and stored, preferably in

multiple Center for Plant Conservation approved facilities. The stored seed could also be used in efforts to establish new populations.

7. Periodically review the status of the species and assess the effectiveness of the management plans and other recovery actions; review and revise the recovery plan as needed (Priority 3).

As new information about *S. oregana* var. *calva* becomes available through additional surveys, research, and management experience, the objectives, criteria, and recovery actions in this recovery plan should be reviewed and revised as necessary. Of specific importance may be evaluations of future research and management needs and the need for reintroductions of additional populations.

8. Develop outreach materials to provide information about the species and its habitat to local landowners (Priority 3).

Additional populations of *S. oregana* var. *calva* may be present on private lands or lands that have not been previously accessed for surveys. The development of informational materials that will assist members of the public in recognizing the species, appreciating its significance, and contacting the appropriate person(s) with location data may help to identify currently unknown populations.

III. IMPLEMENTATION SCHEDULE

The following table is a summary of the scheduled actions and estimated costs for recovery of *S. oregana* var. *calva*. It is a guide for meeting the objectives discussed in Part II of this recovery plan. Initiation of the actions identified in the Implementation Schedule are subject to availability of funds. The table includes the following elements:

1) Priority. The actions identified in the Implementation Schedule are those that, in our opinion, should bring about the recovery of this species. The actions, however, are subject to modification as dictated by new findings, changes in the species' status, and the completion of recovery actions. The priority for each action is given in the first column and is assigned as follows:

- | | |
|--------------------------|---|
| <i>Priority 1</i> | An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. |
| <i>Priority 2</i> | An action that must be taken to prevent a significant decline in the species' population/habitat quality or some other significant negative impact short of extinction. |
| <i>Priority 3</i> | All other actions necessary to meet the recovery objective. |

2) Action Number and Description. The action number and description are extracted from the stepdown narrative found in Part II of this recovery plan.

3) Action Duration. The action duration column indicates the number of years estimated to complete the action if it is a discrete action, or if it is a continuous or ongoing action. Actions are defined as follows:

- | | |
|----------------------------|---|
| <i>Continuous</i> | Action will be implemented on an annual basis once it is begun. |
| <i>Ongoing</i> | Action is currently being implemented and will continue until no longer necessary for recovery. |
| <i>Intermittent</i> | Action will be implemented on an "as needed" basis. |

4) Responsible Parties. We have identified agencies and other parties that we believe are the primary stakeholders in the recovery process, and that have the authority, responsibility, or expressed interest to implement a specific recovery action. However, the list of possible stakeholders is not limited to the list below; other stakeholders are invited to participate. In addition, the listing of a party in the Implementation Schedule does not require, nor imply a requirement, that the identified party has agreed to implement the action(s) or to secure funding for implementing the action(s). However, parties willing to participate may benefit by being able to show in their own budgets that their funding request is for a recovery action identified in an approved recovery plan and is therefore considered a necessary action for the overall coordinated effort to recover *S. oregana* var. *calva*. Also, section 7(a)(1) of the Act directs all Federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of threatened and endangered species.

When more than one party is listed, the most logical lead agency (based on authorities, mandates, and capabilities) has been identified as the “responsible party” with an asterisk (*). The following abbreviations are used to indicate the responsible party for each recovery action:

FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
University	May be any interested academic or research institution
WDNR	Washington Department of Natural Resources

5) Cost Estimates. Cost estimates are shown for each recovery action, both for the first 4 years after release of the recovery plan and for the total estimated cost of recovery over a period of 13 years (2004 through 2016). Total costs for continuous and ongoing actions are based on estimated time to recovery. The inclusion of estimated costs in this recovery plan does not commit any agency or party to an expenditure of funds. Therefore, initiation and completion of these actions is subject to the availability of funds, as well as other constraints affecting the stakeholders involved.

Implementation Schedule for the *Sidalcea oregana* var. *calva* Draft Recovery Plan

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					Comments
					Total Costs	FY 2004	FY 2005	FY 2006	FY 2007	
1	1.1.2	Develop management plan for FS portion of Camas Meadows	3 years	FS	10	5	3	2	—	
1	1.1.3	Coordinate between FS and WDNR on management of Camas Meadows	Ongoing	FS, WDNR*	26	2	2	2	2	
1	1.1.4	Develop management plans for FS and WDNR populations	3	FS*, WDNR*	9	3	3	3	—	
1	1.3.1	Develop site specific management recommendations for landowners	Ongoing	FWS*, WDNR	28	4	2	2	2	
2	1.1.1	Review and update Camas Meadows management plan	Intermittent	WDNR	10	—	—	5	—	Two revisions anticipated over recovery period.
2	1.2	Develop and implement monitoring plans for all known sites	Ongoing	WDNR*, FS, FWS, private	58	4	10	4	4	Increase in second year reflects implementation start-up costs
2	1.3.2	Develop protection on private land	Ongoing	FWS*, WDNR, FS	69	7	7	5	5	

Implementation Schedule for the *Sidalcea oregana* var. *calva* Draft Recovery Plan

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					Comments
					Total Costs	FY 2004	FY 2005	FY 2006	FY 2007	
2	2.1.1	Analyze existing data on habitat requirements	2 years	WDNR*, FS	8	—	4	4	—	
2	2.1.2	Collect and analyze additional data on habitat requirements	4 years	WDNR*, FS	28	7	7	7	7	
2	2.2	Use GIS to identify potential habitat	4 years	FS	24	—	6	6	6	Commencement of this action depends upon initiation of Actions 2.1.1 and 2.1.2
2	2.3	Conduct field investigations of potential habitat	4 years	WDNR*, FS, FWS	20	—	10	5	5	Commencement of this action depends upon initiation of Action 2.2
2	2.4	Map all populations with GPS	Intermittent	WDNR*, FWS, FS	6	—	—	—	2	Commencement of this action depends upon initiation of Action 2.3
2	3.1	Conduct annual weed inventory & control	Ongoing	WDNR*, FS	40	4	3	3	3	
2	3.2	Study weevil predation on seeds	4 years	WDNR*, FS University	13	4	3	3	3	

Implementation Schedule for the *Sidalcea oregana* var. *calva* Draft Recovery Plan

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					Comments
					Total Costs	FY 2004	FY 2005	FY 2006	FY 2007	
2	3.3	Study effects of fire and woody cover removal	Ongoing	WDNR*, FS & FWS	75	10	10	5	5	
2	3.4	Identify pollinators	3 years	WDNR*, University	12	—	4	4	4	
3	2.5	Create and maintain database for survey results	Ongoing	WDNR*, FS	29	5	2	2	2	
3	3.5	Develop a model of annual reproductive success	5 years	WDNR*, FS	54	6	4	4	4	
3	3.6	Study effects of ground disturbance	8 years	WDNR*, FS	45	10	5	5	5	
3	3.7	Determine how to establish viable populations	5 years	WDNR*, FS, University	30	10	8	4	4	
3	4.1	Develop a reintroduction plan	3 years	WDNR	20	—	8	8	4	
3	4.2	Implement reintroduction plan	10 years	WDNR*, FS	80	—	—	8	8	Commencement of this action depends upon initiation of Action 4.1

Implementation Schedule for the *Sidalcea oregana* var. *calva* Draft Recovery Plan

Action Priority	Action Number	Action Description	Action Duration (years)	Responsible Parties	Cost Estimate (in \$1,000 units)					Comments
					Total Costs	FY 2004	FY 2005	FY 2006	FY 2007	
3	5	Establish a technical working group	Intermittent	FWS*, WDNR	20	5	—	5	—	Intermittent costs associated with meetings of technical working group
3	6	Collect and store seed	Continuous	WDNR*, FWS, FS, University	52	4	4	4	4	
3	7	Review and revise recovery plan	Intermittent	FWS*, WDNR, FS	10	—	—	—	—	
3	8	Develop outreach materials	1 year	FWS	10	10	—	—	—	
TOTALS					786	100	105	100	79	

IV. LITERATURE CITED

- Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Covelo, California. 493 pp.
- Caplow, F. 2002. Report on the status of *Sidalcea oregana* (Nutt.) Gray var. *calva* C.L. Hitchcock. Unpublished report prepared for the U.S. Fish and Wildlife Service by the Washington Natural Heritage Program, Department of Natural Resources, Olympia, Washington. 33 pp.
- Center for Plant Conservation. 2003. Web Site of the Center for Plant Conservation. Available at <<http://www.centerforplantconservation.org>>. Web page specific to *S. oregana* var. *calva* available online at <http://ridgwaydb.mobot.org/cpcweb/CPC_ViewProfile.asp?CPCNum=3983>. Accessed 31 March 2003.
- Everett R., D. Schellhaas, D. Spurbeck, P. Ohlson, D. Keenum, and T. Anderson. 1997. Structure of northern spotted owl nest stands and their historical conditions on the eastern slope of the Pacific Northwest Cascades, USA. *Forest Ecology and Management* 94:1-14.
- Gamon, J.G. 1987. Report on the status of *Sidalcea oregana* (Nutt.) Gray var. *calva* C.L. Hitchcock. Unpublished report to the U.S. Fish and Wildlife Service, Olympia, Washington. 41 pp.
- Gilpin, M.E., and M.E. Soulé. 1986. Minimum viable populations: processes of species extinction. Pages 19–34 in M.E. Soulé, editor. *Conservation biology: the science of scarcity and diversity*. Sinauer Associates, Inc, Sunderland, Massachusetts. 584 pp.
- Given, D.R. 1995. Pages 63–65 in *Principles and practices of plant conservation*. Timber Press, Portland, Oregon. 292 pp.

- Goldsmith, T. 2003. Factors affecting population growth and persistence of *Sidalcea oregana* (Nutt.) Gray var. *calva* C.L. Hitchcock (Malvaceae), a taxon endemic to Chelan County, Washington. Unpublished M.S. thesis. University of Washington. 61 pp.
- Harrod, R.J. 1995. The effects of the Hatchery and Rat Creek Fires on endangered, threatened and sensitive plant species. Unpublished report. Wenatchee National Forest, U.S. Department of Agriculture Forest Service. 19 pp.
- Hitchcock, C.L., and A. Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press, Seattle, Washington. 730 pp.
- Hitchcock, C.L., and A.R. Kruckeberg. 1957. A study of the perennial species of *Sidalcea*. University of Washington Publications in Biology, Number 18. University of Washington Press, Seattle, Washington. 96 pp.
- Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1961. Vascular plants of the Pacific Northwest. Part 3: Saxifragaceae to Ericaceae. University of Washington Press, Seattle, Washington. 614 pp.
- Huseby, P. 2000. A preliminary study of seed germination in *Sidalcea oregana* var. *calva*. Unpublished paper submitted to Dr. Sarah Reichard, Ecosystem Science Division and Center for Urban Horticulture, University of Washington, Seattle, Washington. 9 pp.
- North American Rock Garden Society. 1996. A seed exchange society on the internet, available online at <<http://www.nargs.org>>. Accessed 31 March 2003.
- Schemske, D.W., B.C. Husband, M. H. Ruckelshaus, C. Goodwillie, I. M. Parker, and J. G. Bishop. 1994. Evaluating approaches to the conservation of rare and endangered plants. *Ecology* 75:584–606.

- Soulé, M.E. 1980. Thresholds for survival: maintaining fitness and evolutionary potential. Pages 135-150 *in* M.E. Soulé and B.A. Wilcox, editors. Conservation biology: an evolutionary-ecological perspective. Sinauer Associates, Sunderland, Massachusetts. 395 pp.
- U.S. Department of Agriculture and U.S. Department of the Interior. 1994a. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. U.S. Department of Agriculture and U.S. Department of the Interior, Washington, D.C. 2 volumes and appendices.
- U.S. Department of Agriculture and U.S. Department of the Interior. 1994b. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl. U.S. Department of Agriculture and U.S. Department of the Interior, Washington, D.C.
- U.S. Fish and Wildlife Service. 1983a. Endangered and Threatened Species Listing and Recovery Priority Guidance. Federal Register 48:43098-43105.
- U.S. Fish and Wildlife Service. 1983b. Endangered and Threatened Species Listing and Recovery Priority Guidelines Correction. Federal Register 48:51985.
- U.S. Fish and Wildlife Service. 1999. Determination of Endangered Status for *Sidalcea oregana* var. *calva* (Wenatchee Mountains Checker-Mallow). Federal Register 64:71680-71687.
- U.S. Fish and Wildlife Service. 2001. Final Designation of Critical Habitat for *Sidalcea oregana* var. *calva* (Wenatchee Mountains Checker-Mallow). Federal Register 66:46536-46548.

Washington Department of Natural Resources. 2002. Report on the status of *Sidalcea oregana* (Nutt.) Gray var. *calva* C.L. Hitchcock. Unpublished report. Washington Natural Heritage Program, Olympia, Washington. 48 pp.

Washington Natural Heritage Program. 1997. Endangered, threatened, and sensitive vascular plants of Washington with working lists of rare non-vascular species. Washington Department of Natural Resources, Olympia, Washington. 62 pp.

Washington Natural Heritage Program and U.S. Bureau of Land Management. 1998. Field Guide to Selected Rare Plants of Washington. Available online at <<http://www.dnr.wa.gov/nhp/refdesk/fguide/htm/fgmain.htm>>. Accessed 3 April 2003.

Personal Communications and Personal Observations

Gamon, John. 1997. Program Manager, Washington Department of Natural Resources, Natural Heritage Inventory, Olympia, Washington.

Harrod, Richy. 1996. Fire Ecologist, Wenatchee National Forest, Leavenworth Ranger District. Currently stationed in Wenatchee, Washington.

Malmquist, Lauri. 2001. Botanist, Wenatchee National Forest, Leavenworth Ranger District, Leavenworth, Washington.

Thomas, Ted. 1995. Ecologist, U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, Washington.

Wilderman, David. 1997, 2003. Natural Area Preserve Scientist, Washington Department of Natural Resources, Cle Elum, Washington.

V. APPENDICES

APPENDIX A. Summary of threats identified for *Sidalcea oregana* var. *calva* and recommended recovery actions. Recovery criteria addressed by the recommended actions are also identified.

<i>LISTING FACTOR</i> ¹	<i>THREAT</i>	<i>RECOVERY CRITERIA</i> ²	<i>RECOVERY ACTION</i>
A	Alterations of wetland function	1, 2, 4, 5, 6	Develop management plans that discourage conversion of habitat, protect and restore wetland hydrology (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1), establish a working group (Action 5), conduct research and analyze data on habitat characteristics (Actions 2.1.1, 2.1.2)
A	Agricultural and rural residential development, conversion of habitat for other uses (orchards), timber harvest	1, 2, 4, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1), develop protection on private land (Action 1.3.2), establish a working group (Action 5)
A, C	Livestock grazing	1, 2, 4, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1) to include livestock management, develop protection on private land (Action 1.3.2), establish a working group (Action 5)
A	Road construction and maintenance	1, 2, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1), establish a working group (Action 5)
A	Forest fires and fire suppression activities	1, 3, 4, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1), cooperate with fire management agencies (WDNR and FS) to identify and mark plant locations (Action 2.4), conduct research on the effects of ground disturbance (Action 3.6) and the effects of fire and woody cover removal (Action 3.3)

APPENDIX A. Summary of threats identified for *Sidalcea oregana* var. *calva* and recommended recovery actions. Recovery criteria addressed by the recommended actions are also identified.

<i>LISTING FACTOR</i> ¹	<i>THREAT</i>	<i>RECOVERY CRITERIA</i> ²	<i>RECOVERY ACTION</i>
A	Competition from nonnative plant species	1, 2, 4, 5, 6	Develop management plans that address reducing and eradicating nonnative species, manage nonnative species invasion, monitor invasive species distribution and diversity (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1), conduct annual weed inventory and control measures (Action 3.1)
B	Recreation	1, 2, 4, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1) to address recreational activities, establish a working group (Action 5)
B	Seed collection, plant collection	1, 2, 3, 4, 6	Enforce section 9 prohibitions
C	Insects and herbivory	1, 2, 3, 4, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1) to include monitoring insect infestations and herbivory from domestic and wild animals, conduct research (Action 3.2)
D	No Washington State protection for plants on State and private lands	1, 2, 4, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1) and develop protection on private land (Action 1.3.2), establish a working group (Action 5), enforce section 9 (on Federal land) and section 7 provisions of the Act when there is a Federal agency nexus

APPENDIX A. Summary of threats identified for *Sidalcea oregana* var. *calva* and recommended recovery actions. Recovery criteria addressed by the recommended actions are also identified.

<i>LISTING FACTOR</i> ¹	<i>THREAT</i>	<i>RECOVERY CRITERIA</i> ²	<i>RECOVERY ACTION</i>
E	Random environmental events (drought, wildfire)	1, 4, 5, 6	Develop management plans (Actions 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.3.1), reduce impacts by increasing numbers of populations (surveys, reintroductions) population sizes, and population health (Actions 2.2, 2.3, 3.4, 3.5, 3.7, 4.1, 4.2), collect and store seed (Action 6), develop outreach materials to help identify new populations (Action 8)

¹ **Listing Factors:**

A. The present or threatened destruction, modification, or curtailment of its habitat or range; **B.** Overutilization for commercial, recreational, scientific, or educational purposes (not a current factor); **C.** Disease or predation; **D.** The inadequacy of existing regulatory mechanisms; **E.** Other natural or manmade factors affecting its continued existence.

² **Recovery Criteria:**

1. At least three, self-sustaining populations in each of three 5th field watersheds, or four stable, self-sustaining populations in each of two 5th field watersheds within the historical or current range of the species; each must maintain a 10-year average of at least 500 plants, show evidence of natural reproduction and establishment, and show evidence of increasing or stable population numbers over the same 10-year period.
2. All populations are on protected sites that are owned or managed by a government agency or private conservation organization that identifies enhancement and maintenance of the species and its habitat as the primary management objective for the site; or the site must be protected by a permanent conservation easement or covenant that commits present and future landowners to the conservation of the species.
3. Genetic material is stored in a facility approved by the Center for Plant Conservation
4. Adequate population and habitat monitoring has been established for all of the populations.
5. Management plans have been developed and implemented for all State and federally owned populations.
6. Post-delisting monitoring plans and agreements to continue post-delisting monitoring are in place and ready for implementation at the time of delisting.

Abbreviations:

FS = U.S. Forest Service; NAP = Camas Meadows Natural Area Preserve; WDNR = Washington Department of Natural Resources.

APPENDIX B. Glossary

5th field watershed	In the standardized hierarchical hydrologic unit cataloging system used by the Natural Resources Conservation Service, a 5 th field hydrologic unit, known as a watershed, is represented by 10 digits and is the next unit below the level of the larger 8-digit subbasin. Watersheds are normally between 16,000 and 100,000 hectares (40,000 and 250,000 acres) in size. A 5 th field watershed is generally further divided into several 6 th field watersheds known as subwatersheds, the smallest units in the system.
Endemic	Native to, and restricted to, a well-defined geographic area.
Seral	A stage in the succession of a plant community, not including the climax community.
Subwatershed	The smallest of the units comprising the standardized hierarchical system of hydrologic units. A subwatershed (or 6 th field watershed) is represented by 12 digits, and is usually from 4,000 to 16,000 hectares (10,000 to 40,000 acres) in size, although some may be as small as 1,200 hectares (3,000 acres). See also <i>5th field watershed</i> , above.
Variety	A group of plants or animals of less than species rank; some botanists view varieties as equivalent to subspecies, and other consider them divisions of subspecies.
Watershed	<i>syn.</i> catchment; drainage basin; hydrologic unit. An area of land from which water drains toward a common watercourse in a natural basin. See also <i>5th field watershed</i> , above.